

UTILITY PATENT APPLICATION TRANSMITTAL (Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
TTX0163-US

Total Pages in this Submission

TO THE ASSISTANT COMMISSIONER FOR PATENTSBox Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

METAL-AIR CELL

and invented by:

MING YU HUANGIf a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

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Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below .
2. ☒ Specification having 8 pages and including the following:
 - a. ☒ Descriptive Title of the Invention
 - b. ☐ Cross References to Related Applications (if applicable)
 - c. ☐ Statement Regarding Federally-sponsored Research/Development (if applicable)
 - d. ☐ Reference to Microfiche Appendix (if applicable)
 - e. ☒ Background of the Invention
 - f. ☒ Brief Summary of the Invention
 - g. ☒ Brief Description of the Drawings (if drawings filed)
 - h. ☒ Detailed Description
 - i. ☒ Claim(s) as Classified Below
 - j. ☒ Abstract of the Disclosure

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Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
- a. ☒ Formal Number of Sheets 3 (Sheets)
- b. ☐ Informal Number of Sheets _____
4. ☒ Oath or Declaration
- a. ☐ Newly executed *(original or copy)* ☒ Unexecuted
- b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
- c. ☐ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application,
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Computer Program in Microfiche *(Appendix)*
7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
- a. ☐ Paper Copy
- b. ☐ Computer Readable Copy *(identical to computer copy)*
- c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers *(cover sheet & document(s))*
9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
10. ☐ English Translation Document *(if applicable)*
11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☐ Certificate of Mailing
- ☐ First Class ☐ Express Mail *(Specify Label No.):* _____

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Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☐ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	6	- 20 =	0	x \$18.00	\$0.00
Indep. Claims	1	- 3 =	0	x \$78.00	\$0.00
Multiple Dependent Claims (check if applicable) <input type="checkbox"/>					\$0.00
BASIC FEE					\$690.00
OTHER FEE (specify purpose)					\$0.00
TOTAL FILING FEE					\$690.00

☐ A check in the amount of _____ to cover the filing fee is enclosed.
☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. 03-3836
as described below. A duplicate copy of this sheet is enclosed.

- ☒ Charge the amount of \$690.00 as filing fee.
☐ Credit any overpayment.
☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance,
pursuant to 37 C.F.R. 1.311(b).


Signature

Michael D. Bednarek
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CROWELL & MORING LLP
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Dated: FEBRUARY 10, 2000

CC:

Client's ref: electrochemical cell

File: 0640-5123US/final/Jessica Chen

TITLE

METAL-AIR CELL

FIELD OF THE INVENTION

The present invention relates to an electrochemical
5 cell. More particularly, it relates to a metal-air cell
having a spring for controlling whether the cell is an
opened system or a closed system.

DESCRIPTION OF THE RELATED ART

Electrochemical cells, such as metal-air cells, include
10 an air permeable cathode and a metallic anode separated by
an aqueous electrolyte. During discharge of a metal-air
cell, such as a zinc-air cell, oxygen from the ambient air
is converted at the cathode to hydroxide, zinc is oxidized
at the anode by the hydroxide, and then water and electrons
15 are released to provide electrical energy.

To operate a metal-air cell, it is necessary therefore
to provide a supply of oxygen (air) to the cathode of the
cells. Various structures of the metal-air cells have been
utilized. For example, U.S. patent number 5,362,577 to
20 Pendicini discloses a metal-air cell with a case having a
plurality of openings for exposing the cathode of the metal-
air cell to the atmosphere to allow air to pass through for
reaction at the cathode.

However, the cathode is constantly exposed to air even
25 when the metal-air cell is not in use. This causes the
metal-air cell to discharge, thereby leading to leakage
current and a reduction in cell performance and lifetime.

SUMMARY OF THE INVENTION

30 In view of the above disadvantages, an object of
the invention is to provide a metal-air cell comprising a
spring and o-ring. By the innovation of metal-air cell of
the present invention, an adjustable air inlet is formed to

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control whether the cell is an opened system or a closed system.

The above object is attained by providing a metal-air cell having an anode/electrolyte and a cathode with a separator positioned there-between, said cell comprising: a
5 container having an upper interior surface and a lower interior surface for housing said anode/electrolyte and said cathode; a spring disposed on said upper interior surface; a cover electrically connected to said cathode, and having at
10 least one recess; at least one o-ring disposed on said lower interior surface, facing said at least one recess; wherein said spring is compressed when a predetermined force is applied so that said at least one o-ring and said at least one recess are separated, thereby forming an inlet to
15 introduce air for electrochemical reaction, and said spring is expanded when said predetermined force is removed so that said at least one o-ring is inserted within said at least one recess to obstruct the air.

Furthermore, in the metal-air cell according to the
20 present invention, the predetermined force can be applied by a cell holder.

Furthermore, in the metal-air cell according to the present invention, the container can be a can shaped container.

Furthermore, the metal-air cell according to the
25 present invention can further comprise a gas-permeable membrane disposed around said cathode and along said interior sidewalls to prevent moisture and carbon dioxide from passing the cell. Moreover, the
30 gas-permeable membrane can comprise a hydrophobic material.

The anode is preferably zinc, and the cathode is consists of catalyst such as manganese dioxide.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiment of the invention is hereinafter described with reference to the accompanying drawings in which:

FIG. 1 is a cross-sectional side view of the metal-air cell of the preferred embodiment of the present invention not in use;

FIG. 2 is a cross-sectional side view of a cell holder suitable for the metal-air cell of the preferred embodiment of the present invention; and

FIG. 3 is a cross-sectional side view of the metal-air cell put in the cell holder shown by FIG.2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG.1, and FIG.3, the drawings show a metal-air cell according to an embodiment of the present invention, consisting of an anode/electrolyte 12 and an air cathode 16 with a separator 14 positioned there-between.

The metal-air cell can be, for example, a zinc-air cell.

A container 30 having an upper interior surface US and a lower interior surface LS is provided for housing the slurry anode/electrolyte 12 and the air cathode 16 consisting of catalyst and carbon black. In this embodiment, the container 30 is can-shaped; however, it is understood that other shapes can be used. A flexible spring 24 is disposed on the upper interior surface US, between a metal cover 22 and a container 30. A plastic seal 20, preferably polyester, is attached to the anode/electrolyte 12 and the air cathode 16. An electronic conductor 10 is formed within the central portion of the container 30, between the metal cover 22 and the epoxy cover 36, for collecting the current.

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An electronic conductor 38 is formed along the epoxy seal 36 and extended along the outer surface of the air cathode 16 to electrically connect with the cathode 16, and collect the current. A cathode cover 40, having a circular recess 42 as shown in FIG.3 and a tip 43, is attached on the electronic conductor 38. Preferably, a gas-permeable membrane 18 comprising a hydrophobic material such as a polymeric material is disposed around the air cathode 16, between the interior sidewalls of the container 30 and the air cathode 16, thereby preventing electrolyte leakage and/or moisture from exiting the cell. An o-ring 28 is disposed on the lower interior surface LS, wherein the o-ring is aligned with and facing the recess 42. A neutral cover 32 and a metal shrink label 34 are formed to protect the metal-air cell from short and external damages respectively.

FIG.2 illustrates a cell holder 50 capable of communicating with an external circuit including a holder spring 52 and a support 54. In this embodiment of the invention, support 54 is used to provide a predetermined force on tip 43 when the metal-air cell is placed in cell holder 50. However, it is understood that this predetermined force may come from other sources.

When the metal-air cell is not in use, as shown in FIG.1, the spring 24 is expanded so that the o-ring 28 is inserted within the circular recess 42, thereby obstructing the passage of air. In this closed system, the cathode is not exposed to air, and therefore the gas transfer is stopped.

When the metal-air cell is placed in the cell holder 50, the predetermined force is applied by support 54 of the cell holder 50 to tip 43 of the metal-air cell. By this means, the spring 24 is compressed so that the o-ring 28 and the recess 42 are separated, thereby forming inlet 60. In this

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open system, air is introduced through inlet 60 to air cathode 16, allowing for electrochemical reaction to provide electronic energy.

When the metal-air cell is removed from the cell holder
5 50, the spring 24 is once again expanded so that the o-ring 28 is re-inserted into recess 42 to obstruct air and stop the gas transfer .

According to the of metal-air cell of the present invention, at least one circular recess and corresponding O-
10 ring are provided. However, it is understood that more than one recess and o-ring can be utilized. The insertion and removal of the at least one o-ring into the corresponding at least one circular recess closes and opens air inlet 60, thereby controlling whether the system is opened or closed.
15 By this means, the lifetime and performance of the metal-air cell can be improved.

While the invention has been described with reference to various illustrative embodiments, the description is not intended to be construed in a limiting sense. Various
20 modifications of the illustrative embodiments, as well as other embodiments of the invention, will be apparent to those persons skilled in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications or embodiments as
25 may fall within the scope of the invention defined by the following claims and their equivalents.

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What is claimed is:

1 1. A metal-air cell having an anode/electrolyte and a
2 cathode with a separator positioned there-between, said cell
3 comprising:

4 a container having an upper interior surface and a
5 lower interior surface for housing said anode/electrolyte
6 and said cathode;

7 a spring disposed on said upper interior surface;

8 a cover electrically connected to said cathode and
9 having at least one recess;

10 at least one o-ring disposed on said lower interior
11 surface facing said at least one recess;

12 wherein said spring is compressed when a predetermined
13 force is applied so that said at least one o-ring and said
14 at least one recess are separated, thereby forming an inlet
15 to introduce air for electrochemical reaction; and said
16 spring is expanded when said predetermined force is removed
17 so that said at least one o-ring is inserted within said at
18 least one recess to obstruct the air.

1

1 2. A metal-air cell as claimed in Claim 1,
2 wherein said predetermined force is applied by a cell
3 holder.

1

1 3. A metal-air cell as claimed in Claim 1,
2 wherein said container is a can-shaped container.

1

1 4. A metal-air cell as claimed in Claim 1,
2 further comprising a gas-permeable membrane disposed
3 around said cathode and along said interior sidewalls
4 to prevent moisture from exiting the cell.

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1 5. A metal-air cell as claimed in Claim 4,
2 wherein said gas-permeable membrane comprises a
3 hydrophobic material.

1

1 6. A metal-air cell as claimed in Claim 1,
2 wherein said anode is consisted of zinc.

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ABSTRACT OF THE DISCLOSURE

A metal-air cell having an anode/electrolyte and a cathode is disclosed. The metal-air cell comprises a container having an upper interior surface and a lower interior surface for housing said anode/electrolyte and said cathode; a spring disposed on said upper interior surface; a cover electrically connected to said cathode, and having at least one recess; at least one o-ring disposed on said lower interior surface facing said at least one recess. The spring is compressed when a predetermined force is applied so that said at least one o-ring and said at least one recess are separated, thereby forming an inlet to introduce air for electrochemical reaction. The spring is expanded when said predetermined force is removed so that said at least one o-ring is inserted within said at least one recess to obstruct the air.

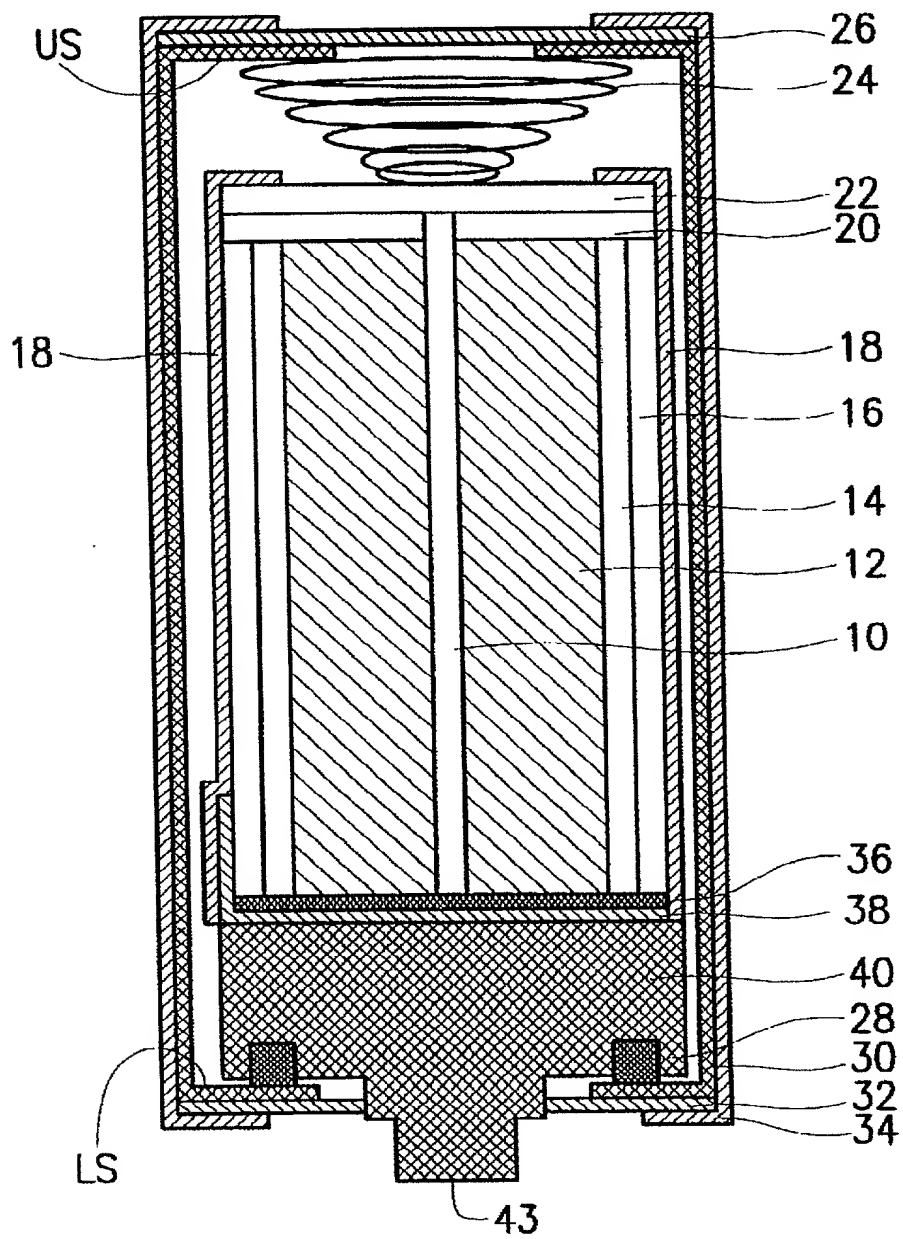


FIG. 1

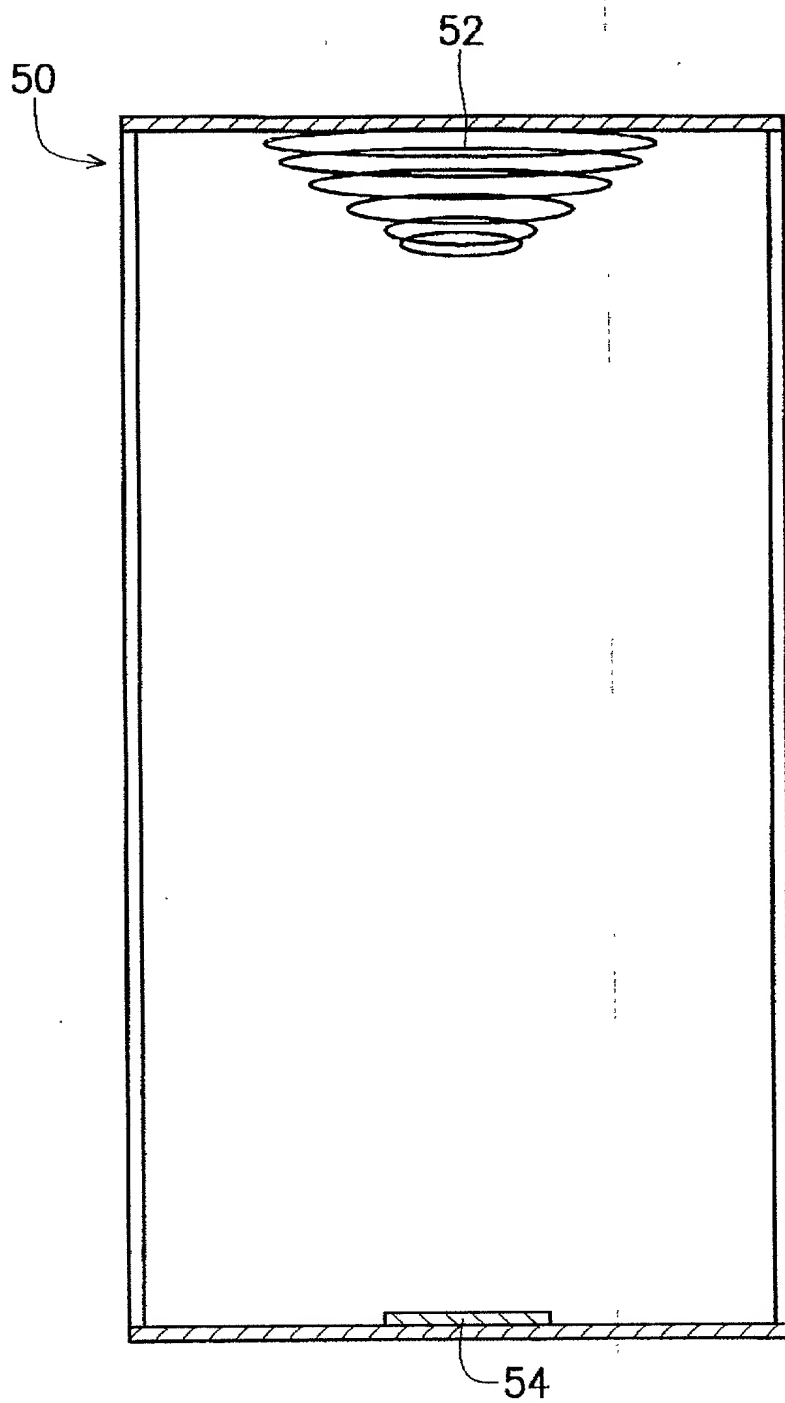


FIG. 2

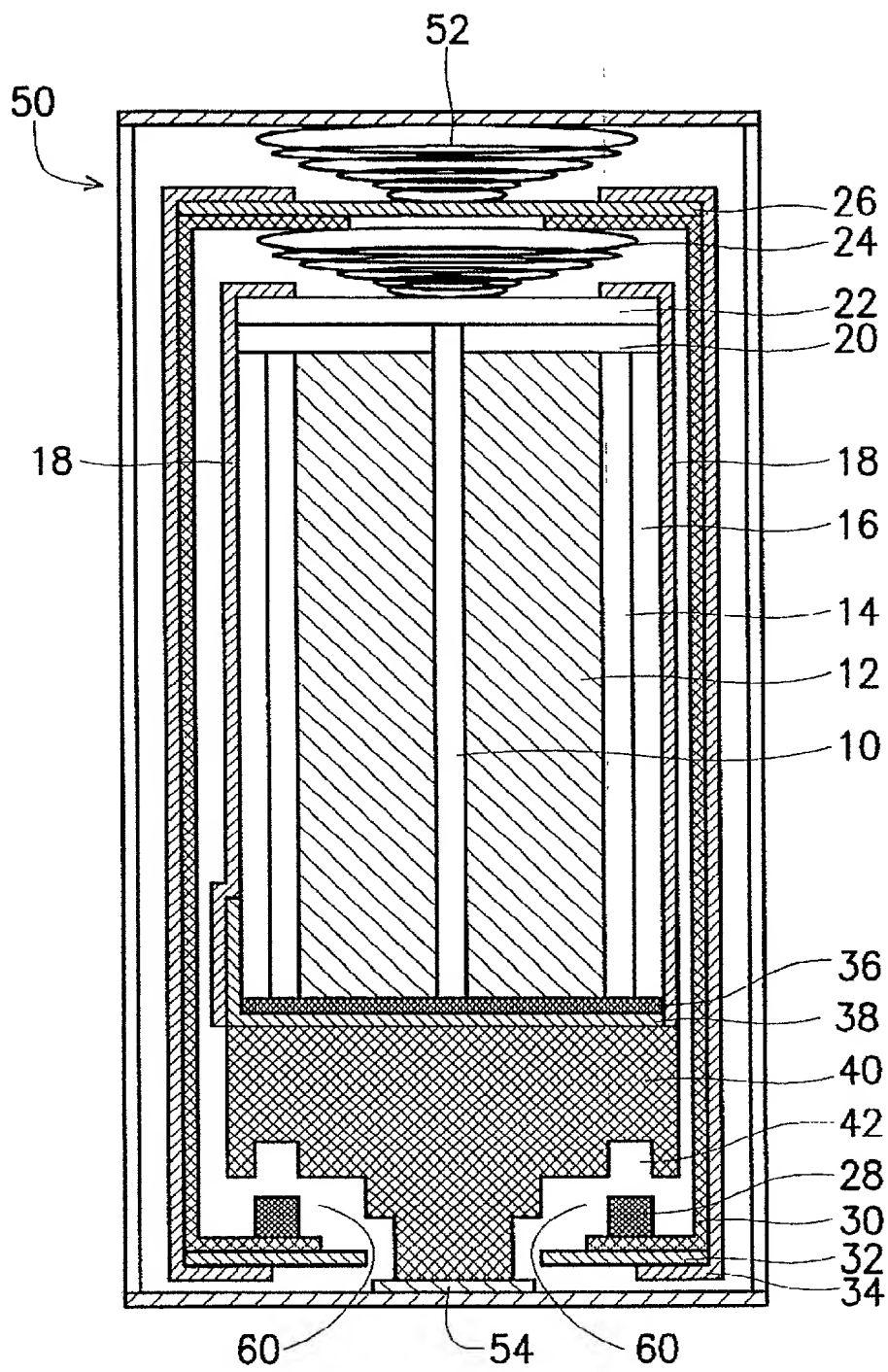


FIG. 3

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Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"METAL-AIR CELL"

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

_____ (Application Serial No.)	_____ (Filing Date)
_____ (Application Serial No.)	_____ (Filing Date)
_____ (Application Serial No.)	_____ (Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)
_____ (Application Serial No.)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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Second inventor's signature	Date
Residence	
Citizenship	
Post Office Address	